

REMARKS

Claims 1-20 are pending in the application; claims 1-9 have been withdrawn pursuant to 37 CFR 1.142(b).

Applicant acknowledges, with appreciation, the indication by the Examiner that claim 16 would be allowed if rewritten in independent form. Applicant has amended this claim by incorporating the features of independent claim 10 from which it directly depended. Claim 16 necessarily included these features and thus this amendment does not affect the scope of this claim. Accordingly, claims 10-15 and 17-20 are currently under consideration, claim 16 being ready for allowance.

Claim 20 was amended to more clearly claim the subject matter sought for protection. In particular, claim 20 was amended to make clear that no catalyst is added to the catalyst bed when reusing it to form the second carbonaceous article. Based on the nature of this amendment, it is respectfully submitted that no new matter issues are raised thereby.

Rejection Under 35 U.S.C. 112

Claim 20 was rejected under 35 U.S.C. 112, second paragraph, as being indefinite. In particular, the Examiner requested that the phrase "re-seeding the catalyst bed" be made clearer in this claim. Applicant has amended claim 20 to recite that no catalyst is added to the catalyst bed when reusing the bed to form the second carbonaceous article. Applicant respectfully submits that this amendment clarifies the subject matter of the claim. Reconsideration and withdrawal of the rejection are respectfully solicited.

Rejection Under 35 U.S.C. 103

Claims 10-15 and 17-19 were rejected under 35 U.S.C. 103(a) as being unpatentable over Resasco (U.S. 6,333,016) in view of Xu (U.S. 5,973,444). The rejection is traversed and it is respectfully submitted that claims 10-15 and 17-19 are patentable within the meaning of 35 U.S.C. 103(a). Reconsideration is respectfully solicited.

Independent claim 10 pertains to a method of manufacturing a carbonaceous article. The method comprises: contacting a carbon containing precursor with a metal catalyst to form the carbonaceous article; applying a magnetic field near the metal catalyst during the formation of the carbonaceous article; and separating the formed carbonaceous article from the metal catalyst. Independent claim 19 adds the additional step of reusing the catalyst to form a second carbonaceous article. Dependent claims 11-15, 17-18 and 20 define further aspects of the methods.

Applicant has discovered that various yield and processing problems arising in fabricating carbon-based structures can be addressed by reducing the mobility of catalyst during the formation of such products. See, e.g. page 5, beginning at line 9 of the present specification. This can be accomplished by applying a magnetic field near the catalyst during formation of the carbonaceous products to more or less fix the catalyst in place thereby reducing catalyst contamination. The presently claimed subject matter requires that the formed products be separated from the catalysts from which they were prepared so that the carbon-based products can be used in other applications.

In formulating the rejection of the claimed subject matter, the Examiner selectively choose parts of the cited references to reconstruct the claims. Applicant respectfully submits that this selective choosing is not a proper manner to form a *prima facie* case under 35 U.S.C. 103(a). It is respectfully submitted that when these references are considered for all that they teach, and in context, there is no identifiable motivation to make the combination asserted by the Examiner.

Resasco, the primary reference, relates to methods of producing commercial quantities of carbon nanotubes at low temperatures through the use of certain catalyst systems that purportedly act synergistically to produce high yields of the product. Resasco specifically teaches that his methods include:

- i) removing the manufactured nanotubes and attached metallic catalyst from the reactor in which nanotubes were formed; and then
- ii) separating the nanotubes from the metallic catalyst.

There is no teaching or suggestion, whatsoever, of applying a magnetic field near the metal catalyst during the formation of the carbon nanotubes, let alone independent claims 10 and 19.

In the Office Action, the Examiner asserted that it would have been obvious to reuse the catalyst in the process of Resasco in order to reduce the need for expensive catalyst. Applicant respectfully submits that the Examiner has not appreciated the problems associated with the manufacture of carbonaceous products and traverses this assertion.

Applicant has noted that a problem associated with the manufacture of carbon nanotubes is the contamination of the metal catalyst. (See, e.g., page 2, beginning at line 19). Resasco has also noted that metals are present in the carbon products made according to his methods. (See, e.g., column 6, lines 12-15; column 13, lines 41-45). Resasco has not indicated that the metal catalyst in the formed product is problematic. Resasco has taught, albeit indirectly, that the catalyst remains attached to the carbon product, thus requiring its removal. (See, e.g., column 13, lines 41-44). It is apparent from Resasco, and the discussions in the present application, that the reuse of a catalyst bed without the addition of catalyst to form a second batch of carbon products is not trivial. Hence, while manufacturers would prefer to reduce their costs and reuse a catalyst bed as suggested by the Examiner, this ignores manufacturing reality. There is no suggestion in Resasco for the reuse of a catalyst bed to form a second carbonaceous article, let alone independent claim 19.

Moreover, the generalization with respect to the universal desire to reduce costs is just that--a generalization. It has been judicially held that generalizations do not provide the requisite motivation to modify a specific reference in a specific manner to arrive at a specifically claimed invention. *In re Deuel*, 51 F.3d 1552, 34 USPQ2d 1210 (Fed. Cir. 1995).

Xu does not cure the deficiencies of Resasco. Xu does not, in any respect, describe the manufacture of carbonaceous articles that are separate from its devices. Rather, Xu is directly concerned with the manufacture and operation of field emission devices. Referring to Figure 1 of Xu, these devices consist of several integrated structures, including a substrate (12), a pattern metal catalyst film (14) on the substrate, a patterned gate metal film (15) on a corresponding dielectric film (16) with gate openings (18), and carbon fiber emitters (20). (See, column 5, lines 24-30). Hence, as discussed in the Background section of the present application (page 2, lines 14-18), Xu discloses a

carbon fiber based field emission device, where the carbon fiber emitters are grown and retained on a catalyst as part of that device.

Xu does not suggest to one of ordinary skill in the art, in any respect:

- i) removing the grown fibers and catalysts from these devices; or
- ii) separating the fibers from the catalyst.

Indeed, Xu teaches the opposite.

Xu teaches growing fibers as part of an integrated device. The grown fibers of Xu must be attached to the device in order for the device to function. Separating the carbon fibers from the field emission device would render the device unsuitable for its intended purpose.

In the Office Action, the Examiner characterized Xu as teaching a method for producing carbon nanotubes. Applicant respectfully submits that this characterization of Xu is misleading. Xu relates to the manufacture and operation of field emission devices.

The Examiner further asserted that Xu uses his magnetic field for the same purpose as Applicant. Not so. As discussed above, the claimed subject matter is directed to forming carbonaceous articles that are separated from catalyst -- this is the opposite of Xu.

Further, the Examiner's official notice of the subject matter of claims 17-18 is traversed. To the extent the Examiner believes it is well known to those of skill in the art to modify the primary reference to arrive at Applicant's claimed subject matter, Applicant respectfully requests that the Examiner provide objective evidence sufficient to establish his assertion. M.P.E.P. 2144.03.

Applicant further takes issue with the combination of Resasco and Xu. In combining these references, the Examiner reasoned that it would have been obvious to one of ordinary skill at the time of the invention to use a magnetic field as taught by Xu, in the process of Resasco, in order to produce straighter nanotubes. Applicant respectfully disagrees.

First, there is no indication from the cited art that there is a desire for straighter fibers, apart from the field emission devices of Xu, or that that fibers produced according to Resasco would necessarily be straighter by employing a magnetic field. In addition to the lack of any identifiable desire for straighter carbon fibers, the Examiner has also

failed to show that there would be any expectation of successfully achieving a straighter carbon fiber in the process of Resasco.

More to the point, Xu has nothing to do with the production of carbon-based products and, thus, does not suggest even their manufacture. Applicant respectfully submits that the Examiner's analysis impermissibly relies on the hindsight reconstruction of the claimed subject matter. *In re Sang Su Lee*, 61 U.S.P.Q.2D 1430 (Fed. Cir. 2002)(quoting *In re Kotzab*, 217 F.3d 1365, 1371, 55 USPQ2d 1313, 1317 (Fed. Cir. 2000) ("particular findings must be made as to the reason the skilled artisan, with no knowledge of the claimed invention, would have selected these components for combination in the manner claimed").

There is no realistic reason to modify the primary reference, which describes a purported synergistic catalyst for producing carbon nanotubes, with the out-of-context teaching of Xu, which directly relates to field emission devices. Obviousness can only be established by combining or modifying the teachings of the prior art to produce the claimed invention where there is some teaching, suggestion, or motivation to do so found either in the references themselves or in the knowledge generally available to one of ordinary skill in the art. *In re Fine*, 837 F.2d 1071, 5 USPQ2d 1596 (Fed. Cir. 1988); *In re Jones*, 958 F.2d 347, 21 USPQ2d 1941 (Fed Cir. 1992); M.P.E.P. § 2143.01.

Xu does not teach applying a magnetic field to produce fibers in general, but rather in the context of fabricating a field emission device. Applicant respectfully submits that there is no realistic motivation to go forward from specific teachings of Resasco and that of Xu to arrive at the claimed subject matter within the meaning of 35 USC 103(a).

Based on the foregoing, Applicant respectfully submits that the claimed subject matter is patentable within the meaning of 35 U.S.C. 103. Favorable consideration and allowance of the application are respectfully solicited.

Attached hereto is a marked-up version of the changes made to the specification and the claims by the current amendment. The attached page is captioned "**VERSION WITH MARKINGS TO SHOW CHANGES MADE**".

To the extent necessary, a petition for an extension of time under 37 C.F.R. 1.136 is hereby made. Please charge any shortage in fees due in connection with the filing of this paper, including extension of time fees, to Deposit Account 500417 and please credit any excess fees to such deposit account.

Respectfully submitted,

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VERSION WITH MARKINGS TO SHOW CHANGES MADE

IN THE CLAIMS:

Claims 16 and 20 have been amended as follows:

16. (Amended) ~~The method according to claim 10, comprising~~ A method of manufacturing a carbonaceous article, the method comprising:

contacting a carbon-containing precursor with a metal catalyst to form the carbonaceous article;

applying a magnetic field near the metal catalyst during the formation of the carbonaceous article; and

separating the formed carbonaceous article from the catalyst by applying a stream of gas.

20. (Amended) The method according to claim 19 comprising reusing the catalyst bed to form the second carbonaceous article without ~~re-seeding~~ adding catalyst to the catalyst bed.